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FINAL REPORT

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EFFECTS OF CASTRATION TECHNIQUES AND ANESTHETICS ON BEHAVIOR AND PERFORMANCE FEEDLOT BULLS

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Effects of Castration Techniques and Anaestetics on Behaviour and Performance of Feedlot Bulls.

Principal Investigator: Joseph M. Stookey
Collaborators: John Campbell, Eugene Janzen, and John McKinnon

Technical Report
Background:

In the production of our livestock and poultry species, a majority of the animals may experience some painful procedures within their lifetime. Such procedures may include dehorning, castration, branding, tail docking, beak trimming, vaccination, etc. all of which may be necessary management procedures depending upon the species, gender, rearing conditions or ultimate use of the animal. For any one procedure there is often a multitude of tools, techniques, and various ages during which the procedures are performed. For example, the cattle industry currently performs castration on bulls anywhere from 1 day of age all the way up past sexual maturity. The techniques currently include elastrators, the burdizzo and knives, all of which are normally used without anesthetics. It seems logical to assume that at least one of these techniques is superior, inflicts the least amount of pain and causes the least set back. As an industry we ought to know (society will demand that we know) which procedure is the most humane and we should move in that direction.

Even though we have known for some time that the younger the animal the more rapid is the healing process, the Canadian and American beef industry has continued to perform castration of bulls well past weaning age. This is in contrast to many of the European nations and in the U.K. for instance where the Protection of Animals (Anaesthetics) Acts and the Veterinary Surgeons Acts prohibit the castration of bull calves over 2 months of age by the producer and require a veterinarian and the use of anesthetics for animals over 2 months of age. Currently several equipment manufacturers in North America are marketing elastrator devices designed to fit mature bulls and are advocating delaying castration (see photo ad) because of the additional benefit in growth from endogenous testosterone produced by the testes. We believe, some of the preference by North American producers for a specific castration techniques is due to the fact we are either unaware or unconcerned about the amount of pain the animals may experience during the castration procedure. Furthermore there have been no comparative studies that have conclusively identified which procedure is the least painful.

Switch to Delayed Castration . . .
The Smart Choice
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(Research confirms a 15% improvement)
"The Castration Tool That Works!"
The "Brains" of the Outfit
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Photo Ad. Example of advertizement that promotes the notion that cattle producers should delay castration.

One reason why we do not know which is the best castration technique is because the pain associated with the procedures is not easy to assess. Stress hormones which we would expect to respond to the castration procedure are also elevated by restraint and handling, thereby masking any response due to castration technique. In addition, changes in behavioural posture or activity during or following castration have typically been too crude or subjective to make conclusive statements. However, within the last few years we have developed more sensitive methods to quantify the animal's response during the application of a painful procedure. Previous work in our lab using strain gauges attached to the headgate and squeeze chute for measuring the escape response and the use of image analysis of taped video recordings of the animal's head movement have proved to be sensitive and reliable tools for measuring an animal's response during painful procedures (Schwartzkopf-Genswein et al., 1998).

Objectives:

1) Determine if the behavioural response during and immediately after castration of sexually mature bulls varies depending upon the castration technique and the use of anesthetics.
2) Determine if the weight gain of sexually mature bulls after castration varies depending upon the castration technique.

Experimental Procedures:

Objective 1 A total of 150 bull calves were randomly allotted to 6 treatments. Fifty calves were randomly selected to serve as controls: 25 bulls were castrated and implanted

3 weeks after arrival and 25 kept intact for the duration of the study. The remaining 100 bull calves were randomly allotted in a 2 x 2 factorial design to investigate the impact of castration. Two castration procedures were compared, surgical castration (Newberry knife) vs. rubber rings (elastrator designed for mature bulls), with and without anesthetics. Prior to castration the headgate was equipped with strain gauges hooked up to record the amount of force exerted against the headgate by the cattle during castration. On the day of castration all bulls were run through a chute complex, individually weighed, caught in a headgate and given either saline or an epidural designed to block pain in the hind quarters and testicular region. In addition each animal had two patches of hair clipped on opposites sides (5 x 5 cm) of the body. Within the two clipped areas a surgical staple was applied to serve as an attachment point for the electrodes from a heart rate telemetry transponder. Following injection, each animal was released and we waited a minimum of 5 min. to allow the anesthetic to take effect. After the 5 minutes had elapsed the bulls and steers were brought back into the facility, caught and restrained in the headgate and subjected to their respective treatments. A 10 second baseline recording of heart rate and exertion force was taken prior to the castration of each bull. Control bulls and steers, plus the bulls castrated with the elastrator were restrained in the headgate for a comparable amount of time as the knife castration treatment to equalize the restraint time across all treatments.

The castrations were completed over a 4 day period. Each day an equal number of cattle from each treatment were castrated.

Objective 2: All bulls were weighed on a weekly basis for 28 days following castration and biweekly thereafter until slaughter. On each weigh day bulls on the castration treatment were inspected to determine if the incision site had heal or whether the testicles and scrotum had dropped off.

Results and Discussion

The maximum force exerted against the head gate during the castration treatments is shown in Figure 1. Not surprising, bulls and steers that received an epidural block exerted significantly less force against the headgate compared to their counterparts that were given a saline injection. The bull that were castrated with the Newberry knife without an epidural block exerted more than twice the force against the headgate compared to all other treatments. The Newberry knife caused by far a greater response in the bulls both in exertion force and heart rate. Animals on all treatments had a drop in heart rate as measured from the 10 sec. baseline collected immediately after restraint and again following the castration period. The knife caused a significant drop in heart rate which is likely a reflection of an acute painful response due to castration. Surprisingly the elastic bands did not cause a marked response in heart rate or exertion force immediately following application.

Both castration treatments caused a reduction in weight gain compared to control steers and control bulls. Within the first seven days after castration 23 out of 50 bulls castrated with the Newberry knife lost weight, while only 3 out of 50 on the elastic band treatment lost weight (see Figure 3). However, throughout the duration of the trial both

castration treatments performed at the same level and neither group was able to catch up to the control group prior to slaughter (see Figure 4).

Surprisingly, the elastic bands did not cause an acute response at the time of application. However, the elastic bands did cause a delay in wound healing compared to the knife. None of the testicles or scrotums had fallen off by the 21 day weigh period. Only 6 had fallen off by 28 days post application of the eleastric bands. Even though the scrotums appeared dead before they dropped off, as long as they were attached there was a weeping wound at the site where the live tissue met the band and necrotic tissue. Only 34 of the banded treatment group had dropped their testes and scrotums by the 42 day weigh period. The prolonged period that elasped before the groups were completely healed must have had some negative effect on performance. Neither castration treatment resulted in satisfactory gains or in the time required to heal.

Conclusion: Compared to control steers the data clearly indicates that castration should not be delayed until the animal reaches 350 kg. If one must castrate bulls at a larger weight, we recommend using an epidural block when castrating with the Newberry knife. Castrating with the Newberry knife to open the scrotum and using an emasculator to cut and crimp the chord caused a response indicative of acute pain. To surgically castrate mature bulls without mitigating pain would be deemed inhumane. Castrating mature bulls with elastic bands will result in a prolonged healing time and suboptimum gains.

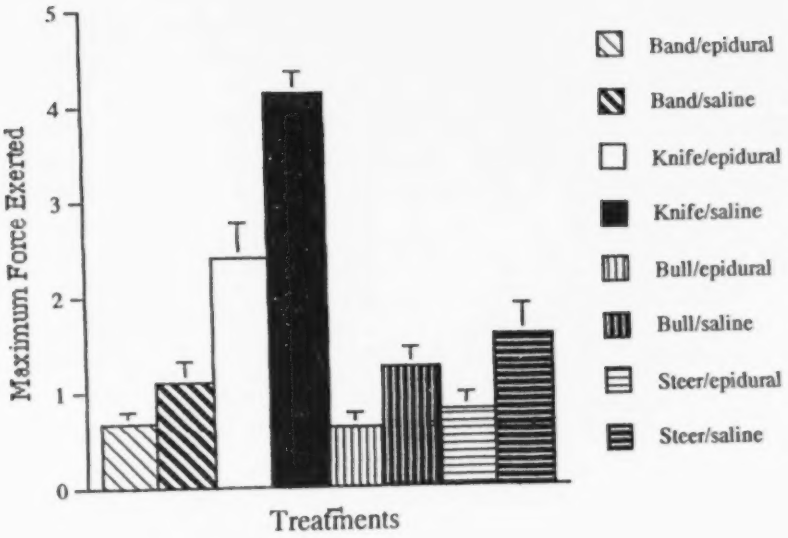

Figure 1 . Maximum force exerted against headgate by cattle during treatment as measured via strain gauge.

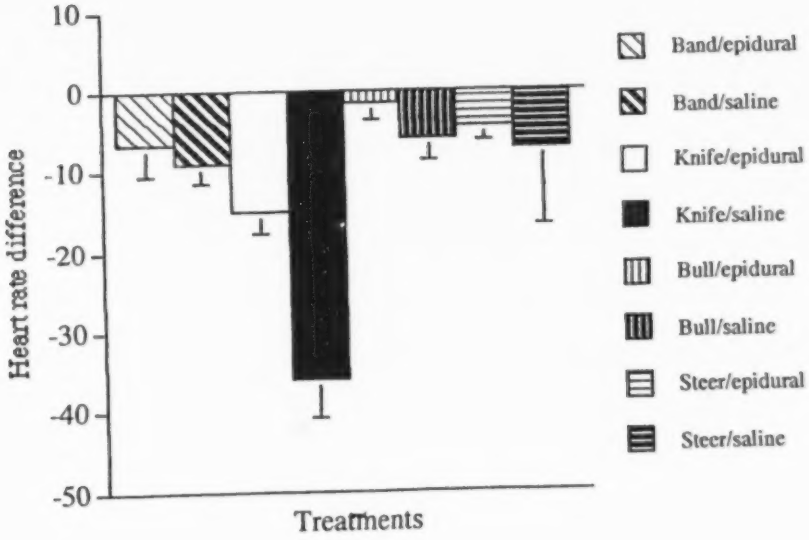

Figure 2. Heart rate difference between pre and post- castration for cattle on various castration treatments.

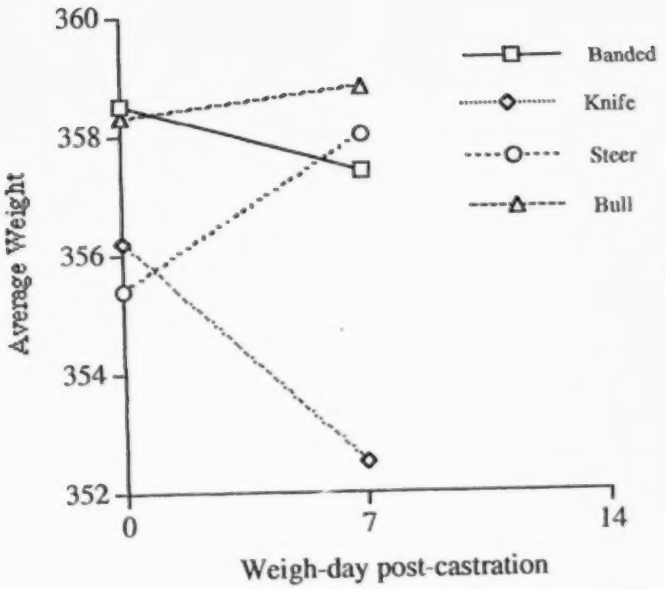

Figure 3. Average weight of bulls and steers at start of tria and on day 7 following castration using the Newberry knife or rubber bands.

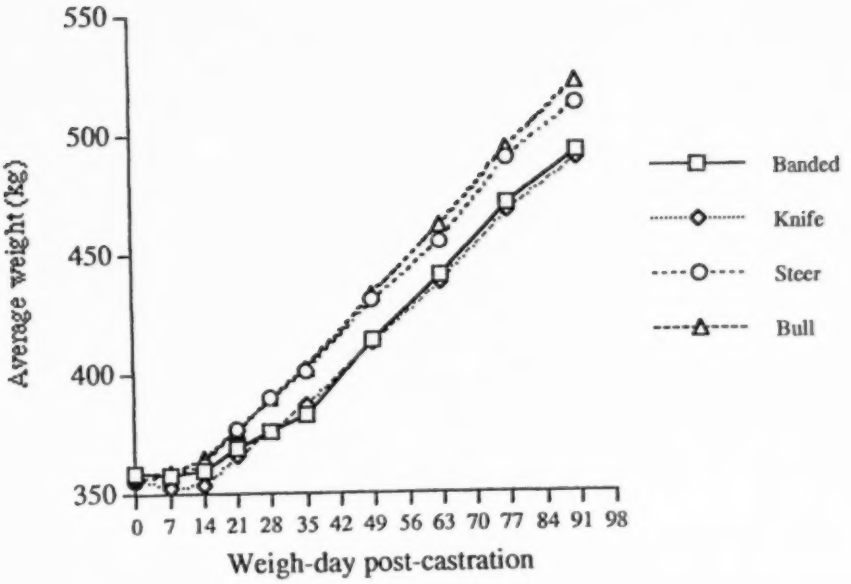

Figure 4. Average weight of bulls and steers at start of trail and on subsequent weigh days following castration with the Newberry knife or rubber rings.

Project presentations: data presented and discussed at:

Stookey, J. M. 2001. Castration and dehorning: We have done the science, when will we use the results? Conference Animal Agriculture 2001. Saskatoon, SK Jan. 12.

No scientific published paper at this time, manuscript in preparation.

Information of benefit to producers, processors or government: The information in this report provides strong evidence against castration of mature bulls. Both procedures could be viewed as inhumane based on performance, pain response and time to heal. Surgically castrating mature bulls without analgesics, based on these results could be viewed as unethical or as an act of cruelty.

Effects of Castration Techniques and Anaestetics on Behaviour and Performance of Feedlot Bulls. Stookey, J. M. , J. Campbell, E. Janzen and J. McKinnon.

Abstract/Summary in lay language

The study used 150 bull calves (ave. wt. 253 kg at start). Twenty five were castrated at the start (to serve as control steers) and 25 were kept intact for the duration of the study (control bulls). When the remaining 100 bulls averaged 357 kg they were castrated to compare surgical castration (Newberry knife) vs. elastic bands (designed for mature bulls), with and without anesthetics. Pain was assessed by recording the heart rate and by quantifying the force exerted against the headgate at the time of castration. The bulls surgically castrated without an epidural block exerted twice the force against the headgate, and showed the greatest changes in heart rate, indicative of an acute pain response. The elastic bands did not cause a marked response in heart rate or exertion force immediately following application, but banded steers remained unhealed for over 40 days. Both castration treatments caused a reduction in weight gain within the first week and neither group was able to catch up to the control groups prior to slaughter. Ideally producers should castrate prior to the animals weighing 350 kgs. We recommend using an epidural block when castrating heavy bulls with the Newberry knife.

Effects of Castration Techniques and Anesthetics on Behaviour and Performance of Feedlot Bulls.

Executive Summary: A brief non-technical report.
Principal Investigator: Joseph M. Stookey
Collaborators: John Campbell, Eugene Janzen and John McKinnon

Background:

Even though we have known for some time that the younger the animal the more rapid is the healing process, the Canadian and American beef industry has continued to perform castration of bulls well past weaning age. This is in contrast to many of the European nations. In the U.K. the Protection of Animals (Anaesthetics) Acts and the Veterinary Surgeons Acts prohibit the castration of bull calves over 2 months of age by producers and requires a veterinarian and the use of anesthetics for animals over 2 months of age. Currently several equipment manufacturers in North America are marketing elastrator devices designed to fit mature bulls. The devices may have some use, but it seems contrary to animal welfare policy to be advocating to producers to delay castration (see Fig 1). We believe, some of the preference by North American producers to delay castration or to use certain castration techniques without anesthetics is due to the fact producers are unaware or unconcerned about the amount of pain the animals may experience during the castration procedure. Furthermore, there have been no comparative studies that have conclusively identified which castration procedure is the least painful.

Switch to Delayed Castration . . .
The Smart Choice
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The NEW Calliérate BANDER

Figure 1. Example of advertisement that promotes the concept that cattle producers should delay castration.

One reason why we do not know which is the best castration technique is because the pain associated with the procedures is not easy to assess. Stress hormones which we would expect to respond to the castration procedure are also elevated by restraint and handling, thereby masking any response due to the castration technique alone. In addition, changes in behavioural posture or activity during or following castration have typically been too crude or too subjective to make conclusive statements. However, within the last few years we have developed more sensitive methods to quantify the animal's response during the application of a painful procedure. Strain gauges attached to the headgate to measure the animal's exertion force, plus heart rate recordings have proved to be sensitive and reliable tools for measuring an animal's response during painful procedures. We now have the techniques to evaluate which castration procedure is more humane.

Project Objectives:

1) Determine if the behavioural response during and immediately after castration of sexually mature bulls varies depending upon the castration technique and the use of anesthetics.
2) Determine if the weight gain of sexually mature bulls after castration varies depending upon the castration technique.

Experimental Procedures:

Objective 1 A total of 150 bull calves were randomly allotted to 6 treatments. Fifty calves were randomly selected to serve as controls: 25 bulls were castrated and implanted 3 weeks after arrival and 25 kept intact for the duration of the study. The remaining 100 bull calves were randomly allotted in a 2 x 2 factorial design to investigate the impact of castration. Two castration procedures were compared, surgical castration (Newberry knife) vs. rubber rings (elastrator designed for mature bulls), with and without anesthetics. Prior to castration the headgate was equipped with strain gauges hooked up to record the amount of force exerted against the headgate by the bulls during castration. On the day of castration all bulls were run through a chute complex, individually weighed, caught in a headgate and given either saline or an epidural designed to block pain in the hind quarters and testicular region. In addition, each animal had two patches of hair clipped on opposites sides (5 x 5 cm) of the body. Within the two clipped areas a surgical staple was applied to serve as an attachment point for the electrodes from a heart rate telemetry transponder. Following injection, each animal was released and we waited a minimum of 5 min. to allow the anesthetic to take effect. After the 5 minutes had elapsed the bulls and steers were brought back into the facility, caught and restrained in the headgate and subjected to their respective treatments. A 10 second baseline recording of heart rate and exertion force was taken prior to the castration of each bull. Control bulls and steers, plus the bulls castrated with the elastrator were restrained in the headgate for a comparable amount of time as the knife castration treatment to equalize the restraint time across all treatments. Immediately after castration bulls were implanted with a commercial growth hormone.

Twenty five bulls were castrated each day such that the castrations were completed over a 4 day period. As near as possible, an equal number of cattle from each treatment were castrated each day.

Objective 2: All bulls were weighed on a weekly basis for 28 days following castration and biweekly thereafter until slaughter.

Results and Discussion

Not surprising, bulls and steers that received an epidural block exerted significantly less force against the headgate compared to their counterparts that were given a saline injection. The bulls that were castrated with the Newberry knife, without an epidural block, exerted more than twice the force against the headgate compared to all other treatments. The Newberry knife caused by far a greater response in the bulls both in exertion force and heart rate. Animals on all treatments had a drop in heart rate as measured from the 10 sec. baseline collected immediately after restraint and again following the castration period. The knife caused a significant drop in heart rate which is likely a reflection of an acute painful response due to castration. Surprisingly, the elastic bands did not cause a marked response in heart rate or exertion force immediately following application.

Both castration treatments caused a reduction in weight gain compared to control steers and control bulls. Within the first seven days after castration 23 out of 50 bulls castrated with the Newberry knife lost weight, while only 3 out of 50 on the elastic band treatment lost weight. However, throughout the duration of the trial both castration treatments performed at the same suboptimum level and neither group was able to catch up in weight to the control groups prior to slaughter.

Conclusions:
The elastrator, while not acutely painful at the time of application, delayed healing and resulted in suboptimum performance in weight gain that was detected up to slaughter. Surgical castration with a Newberry knife and emasculator caused an extreme response in heart rate. The exertion force applied against the headgate by the animal was also indicative of an acute pain response in the surgically castrated group. Surgically castrated bulls also performed at a suboptimum level and were unable to match or catch controls prior to reaching slaughter weight.

Recommendations: Ideally producers should castrate bulls before they reach 350 kg and the beef industry should discourage the castration of mature bulls. Neither the elastrator nor the surgical procedure was ideal. If one must castrate bulls at a larger weight, we recommend using an epidural block when castrating with the Newberry knife. Surgically castrating mature bulls without anesthetics is dangerous for the operator and could be classified as inhumane and unethical. The prolonged delay in healing and the suboptimum performance of the banded bulls also calls into question the acceptability of using an elastrator on mature bulls.